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Specification and Drawings, as originally filed, with Application for Patent Serial No: **2,274,572**, on June 7, 1999, by **STRATEGIC VISTA INTERNATIONAL INC.**, assignee of Joel Kligman, Bernie Klein and Oded Zur, for "Security Alarm System".

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Abstract

A wireless security alarm system providing reliable two-way communication between a base unit and a plurality of peripheral devices, including both sensors and alarm indicators, which may be implemented into a corded or cordless telephone or as a stand-alone system. The system of the invention provides a large number of channels for monitoring both intrusion and environmental conditions, and can include emergency dialing capabilities for the elderly or small children. A monitoring service can monitor the premises, and upon detecting an alarm condition to process audio and/or video data allowing the monitoring service to watch and/or listen to events occurring within the premises and dispatch an appropriate emergency response, and to communicate with persons within the premises during an emergency. The peripherals used in system of the invention can be configured through the base unit and automatically or remotely reconfigured if the controller detects attempts to tamper with peripherals or jam the signals to the base unit. The main controller serves as both a multi-function telephone and the central processing unit of the alarm system. An LCD display displays system status and other desired indicators, and the telephone keypad is used for data entry and activation or deactivation of the alarm system (optionally with a separate key fob remote control). A cellular, pager or two-way radio connection backup may be provided in case of sabotage or failure of the telephone line. Connection to a local or remote personal computer is also available.

SECURITY ALARM SYSTEM

Field of Invention

This invention relates to security alarm systems. In particular, this invention relates to a wireless security alarm system providing reliable two-way communication between a base unit and a plurality of peripheral devices.

Background of the Invention

Security alarm systems are used in homes and in commercial and industrial facilities, for monitoring the premises to detect intruders, fire and environmental hazards such as carbon monoxide contamination. There are two types of security alarm systems: wired and wireless. Although both have been proven effective over many years, security alarm systems are still utilized in a minority of premises because of the cost and limitations of conventional systems.

Much of the cost of installing a wired alarm system is in the wiring, since the peripheral devices such as sensors (typically contact, motion detectors and vibration detectors) and alarm condition indicators (such as sirens, bells and telephone line seizing devices in the case of monitored systems) are dispersed throughout the premises and thus well remote from the base unit. In general it is advantageous to divide the premises into "zones" which are monitored independently, and although the sensors within a zone can be wired in series the zone circuits must be connected to the base unit in parallel in order for the base unit to be able to discriminate between zones.

A lot of wiring is required to adequately cover vulnerable entry points divided into a desirable number of zones, and a service technician installing such a system must thus spend considerable time fishing wires through walls in order to make the alarm system unobtrusive. This is a time consuming and costly procedure, and it is not always possible to

conceal the wiring in structures such as condominiums and apartment buildings, older houses and houses with finished basements.

Wireless alarm systems are also known. In these systems a plurality of different kinds of sensors distributed about the premises each emit a radio frequency (RF) signal with a characteristic frequency. The signal is transmitted when the sensor detects and intrusion, for example a point contact which is broken when a window is forced open or a motion detector which senses motion within its detection field. A receiver contained in a base unit monitors the various RF signals and signals a controller when one or more of the signals is transmitted, indicating an alarm condition.

Wireless alarm systems are considerably easier to install, because peripheral sensors need only be mounted and do not have to be wired to the base unit. However, in a typical wireless system there are a limited number of RF channels available for peripheral sensors, and the cost of the system increases considerably as more channels are added.

Further, these systems provide only one-way communication, i.e. sensor-to-base signals, and thus alarm indication peripherals such as audible indicators and line seizing devices must still be wired to the base unit, which increases installation costs. In some cases the RF signals emitted by the sensors have a limited range before they become subject to interference and unreliability, which can limit the location of such peripherals and/or the base unit itself. Also, the one-way communication of such systems precludes any verification procedure, which can result in false alarms caused by equipment malfunction and lead to costly and unnecessary response by emergency services personnel.

Summary of the Invention

The present invention overcomes these problems by providing a wireless security alarm system providing reliable two-way communication between a base unit and a plurality of peripheral devices, including both sensors and alarm indicators. In the preferred embodiment the base unit of the invention is implemented into a corded or cordless telephone,

providing instantaneous access to a telephone line for monitoring by a security service or auto-dialing to an emergency number. The system of the invention can be easily installed by a home or business owner without any special tools and requires no wiring through the premises. The system of the invention provides a large number of channels for monitoring both intrusion and environmental conditions, and can include emergency dialing capabilities for the elderly or small children.

The alarm system of the invention allows a monitoring service to monitor the premises, and upon detecting an alarm condition to process audio and/or video data allowing a monitoring service to watch and/or listen to events occurring within the premises and dispatch an appropriate emergency response, and to communicate with persons within the premises during an emergency. The peripherals used in system of the invention can be configured through the base unit upon installation, either directly or from a remote location, and automatically or remotely reconfigured if the controller detects attempts to tamper with peripherals or jam the signals to the base unit; to initiate or discontinue a battery-saving "sleep" mode; and/or to adjust environmental controls or pre-programmed procedures. The auto-dial feature can also be configured remotely, allowing a user to remotely select one or more of a plurality of stored telephone numbers for the emergency dialer.

In the preferred embodiment this is accomplished by providing a corded or cordless telephone with a built-in digital communicator having full upload and download capabilities, permitting remote programming, alarm reception and verification and analysis of an alarm condition. The main controller in the preferred embodiment serves as both a multi-function telephone and the central processing unit of the alarm system. An LCD display displays system status and other desired indicators, and the telephone keypad is used for data entry and activation or deactivation of the alarm system (optionally with a separate key fob remote control). The memory may be adapted to store any desired number of alarm events in an event log. Many of these functions are available in corded and cordless telephones, and integrating the alarm system of the invention into such a telephone eliminates unnecessary

duplication of features, thus reducing the cost to the consumer. However, it will be appreciated from the description which follows that the invention may also be implemented as a stand-alone system connected to any suitable communications network.

Utilizing a digital bi-directional digital communication data link, preferably in the 900 MHz frequency range, the alarm system of the invention easily accommodates many different channels each with a unique signal ID, allowing many more peripherals and zone configurations than a conventional wireless alarm system of comparable cost. The signals are reliable over a large distance, in most environments over 100 meters, permitting integration of alarm systems in different premises of a residential or commercial complex or structure. Optionally the communications protocol may operate in any other suitable frequency range, including in the 2.4 GHz range or other larger bandwidth frequencies, for example, allowing for higher speed transfer of video data.

In the preferred embodiment the system of the invention provides a cellular or two-way radio connection backup in case of sabotage or failure of the telephone line, and a self-testing function for monitoring such events. Optionally connection with the system via two-way pager is provided as a further backup measure and/or for direct user response to an alarm condition. The invention can be applied to all conventional intrusion detection peripherals, including glass breakage sensors, and also to environmental monitoring such as smoke and fire detection, hazardous gas detection, temperature, water and/ or moisture detection, etc. Connection to a local or remote personal computer is also available for expanded operation, detailed system analysis and/or integration with other systems.

The present invention thus provides a security alarm system, comprising a keypad for entering data, a display, one or more peripheral sensors, and a base controller, comprising a communication module for controlling a data transfer with a remote location over a communication link, a driver for processing data input via the keypad and displaying data on the display, and an RF transceiver for sending information to and receiving information from the one or more peripheral devices, wherein the base controller

communicates data to the one or more peripheral devices to configure and control said peripheral devices and receives data from the one or more peripheral devices to indicate an alarm condition.

In a further aspect of the invention the base controller is integrated with a telephone set.

Brief Description of the Drawings

In drawings which illustrate by way of example only a preferred embodiment of the invention,

Figure 1 is a perspective view of an embodiment of the alarm system of the invention,

Figure 2 is a schematic plan view of the embodiment of Figure 1, and

Figure 3 is a block diagram illustrating components of the alarm system of the invention.

Detailed Description of the Invention

Figures 1 and 2 illustrate a cordless telephone 10 comprising a handset 12 in communication with a base unit 11. A keypad 14 is provided for dialing the telephone, and for entering alphanumeric data for programming and setting the alarm system in conjunction with scroll button 16. A display 18, for example an LCD window, provides user information in both the telephone and alarm system modes.

According to the invention, a main control unit 20 comprises a base controller 22 in bi-directional communication with:

1) A communication module 24, which controls the data transfer and line seizure functions via telephone link 26, which may be a direct connection to a land line or a wireless connection to a cellular or two-way radio link;

2) A keypad/display 28 driver for processing data input via the keypad 14 and button 16 and displaying information on the LCD display 18;

3) An optional home automation link 30 for controlling peripheral devices such as "actuators". (switches or controllers), for activating and deactivating appliances, lights etc.; and

4) An RF transceiver 32 for sending information to and receiving information from the various peripheral devices 40.

The peripheral devices 40 include sensors 42, which may include point contacts, motion detectors, glass breakage sensors, vibration detectors, temperature and moisture sensors, smoke and hazardous gas detectors, etc., and alarm indicators 44 such as sirens, bells, strobe lights etc., are each equipped with an RF processor 42a or 44a comprising a transceiver adapted to transmit a digital RF signal having a characteristic digital ID code which is recognized by the base controller 22 and associated with a specific zone and/or function.

In the preferred embodiment the base unit 20 communicates with the peripheral devices 40 via a 900 MHz frequency hopping digital spread spectrum RF communications protocol, which is stable over a large distance and resistant to outside interference and ambient noise. Communication preferably occurs at a medium speed (around 115 kbps) through time division multiplexing, however dynamic allocation of the data rate by the base controller 22 allows flexibility when increased throughput or communication reliability is desired for a reduced number of devices. Interference between peripheral signals is prevented by the base controller which synchronizes peripheral transmissions via the base processor 22 whereby the base controller 20 undertakes a sequential or "cascade" tasking of the peripheral sensors 42 and, if status is desired, the peripheral alarm indicators 44.

The network topology is thus organized in a star configuration, with the base unit 20 as the central entity and the sensors 42 and indicators 44 as the peripheral entities. The system preferably supports up to eight pipes of connection between the peripheral devices and

the host applications. The pipes each comprise single data channels, or are combined as data channels in widths of two, four or eight channels bundled together as redundant pipe-as pairs for greater resistance to interference. In addition, a control channel is provided for network control functions such as standby and controlling, tasking and initializing all peripheral devices 40.

A higher number of high latency peripheral devices, hundreds in some situations, can be handled by adding collision handling protocols in the application layer. Moreover, integrated with a cordless telephone, the telephone handset effectively operates as a peripheral device; any number of telephone handsets may be supported by a single telephone embodying the invention, and each handset is capable of programming and configuring the alarm system remotely. The system can also be programmed and configured by data entered into an external telephone set.

The device preferably operates in three modes:

1. Active mode: The device is in data transfer mode while using a data channel, in one of several different latencies optimized for desired preferences, including host latency, battery life and isochronous application.

2. Standby mode: The peripheral devices 40 are communicating with the base unit 20 periodically through the control channel, solely for maintaining network synchronization and control.

3. Suspend mode: The peripheral devices 40 are not communicating with the network. A 'wakeup' signal from the base unit 20 is required to restore communication with the base controller 22.

In operation, the system of the invention is installed at a premises by mounting the desired number and type peripheral devices 40 at desired positions within and about the

premises. The base unit 11 is positioned within the premises at any convenient location. The system may be installed by the user, or by an installer if desired.

Thereafter, the system may be configured on-site or remotely, for example by a monitoring service. The system is initialized and scans for peripheral devices 40. As each device is found by the base controller 22 its type is displayed on the base unit 11 or at the remote location, for example on a personal computer. Using the keypad 14 the operator selects some or all of the located peripheral devices 40 to become active, on an as-needed basis, and the base controller 22 configures the selected peripherals 40 with a lockout code for system integrity and security.

The peripheral devices 40 may also include a telephone handset 46 or microphone/speaker for two-way voice communication within or about the premises; any number of sensors 42; one or more video cameras (not shown); and one or more alarm indicators 44.

A security sensor or an environmental sensor (for example a temperature or humidity sensor) indicates an alarm condition by transmitting its characteristic RF signal to the main control unit 20. In the preferred embodiment the main control unit 20 then sends a signal to the sensor 42 requesting a status signal from the sensor 42, to verify the alarm condition. The main control unit 20 may also, or alternatively, request a status signal from a neighboring sensor 42 (for example a motion detector in the vicinity of a door contact that goes into an alarm condition). If the activated sensor 42 and/or the neighboring sensor 42 indicates in response to the verification request that no alarm condition exists, the main control unit 20 determines whether the alarm indication was false according to parameters programmed into the base controller 22. This can reduce the likelihood of false alarms to produce a more reliable alarm system.

Moreover, the verification request signal transmitted by the main control unit 20 can be an 'acknowledgment' to the sensor 42 that its signal disruption has been logged by

the main control unit 20, failing which after a predetermined interval the sensor 42 may transmit another signal to the main control unit 20 requesting an acknowledgment signal.

In either case the main control unit 20 or the sensor 42 preferably continue to transmit requests for sensor status or acknowledgment until a response signal is received. Thus, the two-way communication between the main control unit 20 and the sensors 42 provide a "smart" system which can verify indications and system conditions before communicating with a monitoring station or activating an alarm indicator 44.

The peripheral devices 40 can be reconfigured, added and removed from the system as needed. For example, in preparation for an off-hours delivery a sensor 42 on the shipping door and a neighboring motion detector can be deactivated, leaving all other sensors 42 active. The system may also activate an actuator controlling the shipping door lock, allowing delivery personnel access to the premises. In this fashion each particular sensor, actuator and alarm indicator can be considered to constitute a "zone".

The main control unit 20 can also be programmed to associate specified groups of peripherals 40 as separate zones, for ease of activating/deactivating portions of the system. These groups can be reconfigured on site or remotely, as desired.

It is also possible using the system of the invention to transmit from, for example a sound detector, rather than simply an indication that sensor 42 has detected a sound, a digital representation of the sound level. Thus, the main control unit 20 can be programmed to ignore sound levels below a certain threshold, to account for ambient noise levels. The threshold can change by a preprogrammed schedule, for example a lower threshold indicates an alarm condition at night, and the threshold can be changed remotely or on site as desired.

Troublesome zones can be repaired or isolated from the system. For example, a vibration sensor that activates persistently over a predetermined interval can be reconfigured, or the main control unit 20 can discriminate from other peripherals by, for

example, not communicating with the monitoring service when the troublesome sensor indicates an alarm condition, but still indicate the alarm condition locally by an alarm indicator 44 and/or in the main control unit's event log, or by auto-dialing one or more stored telephone/pager numbers and playing a pre-recorded message.

In the case of a monitored system, the monitoring service can configure the main control unit 20 to limit the ability of the occupier of the premises to configure certain peripherals or perform other procedures. In the case of a homeowner installed system, the system can be programmed to remain inactive until a monitoring service conducts a diagnostic to confirm that the main control unit 20 and all peripheral devices 40 are operating properly.

Monitoring of so-called "latchkey children" is facilitated by the invention. Preprogrammed arrival times can be selected for one or more children, and the auto-dial or alarm functions can be initiated automatically if a child has not disarmed the system by the arrival time. The child can alternatively wear a sensor 42, which will be detected by the system upon arrival of the child, if desired disarming a designated entry point. These parameters can be reconfigured remotely by the homeowner if circumstances so dictate.

Connection of the system to a personal computer enables Internet access and other on-line functions and capabilities, if desired. This can offer an alternative to telephone, PCS etc. for remote management of the system.

A preferred embodiment of the invention having been thus described by way of example, it will be appreciated by those skilled in the art that certain adaptations and modifications may be made without departing from the scope of the invention. The invention is intended to include all such variations and modifications as fall within the scope of the claims.

WE CLAIM:

1. A security alarm system, comprising

a keypad for entering data,

a display,

one or more peripheral sensors, and

a base controller, comprising

a communication module for controlling a data transfer with a remote location over a communication link,

a driver for processing data input via the keypad and displaying data on the display, and

an RF transceiver for sending information to and receiving information from the one or more peripheral devices,

wherein the base controller communicates data to the one or more peripheral devices to configure and control said peripheral devices and receives data from the one or more peripheral devices to indicate an alarm condition.

2. The alarm system of claim 1 wherein the base controller is contained within a telephone set.

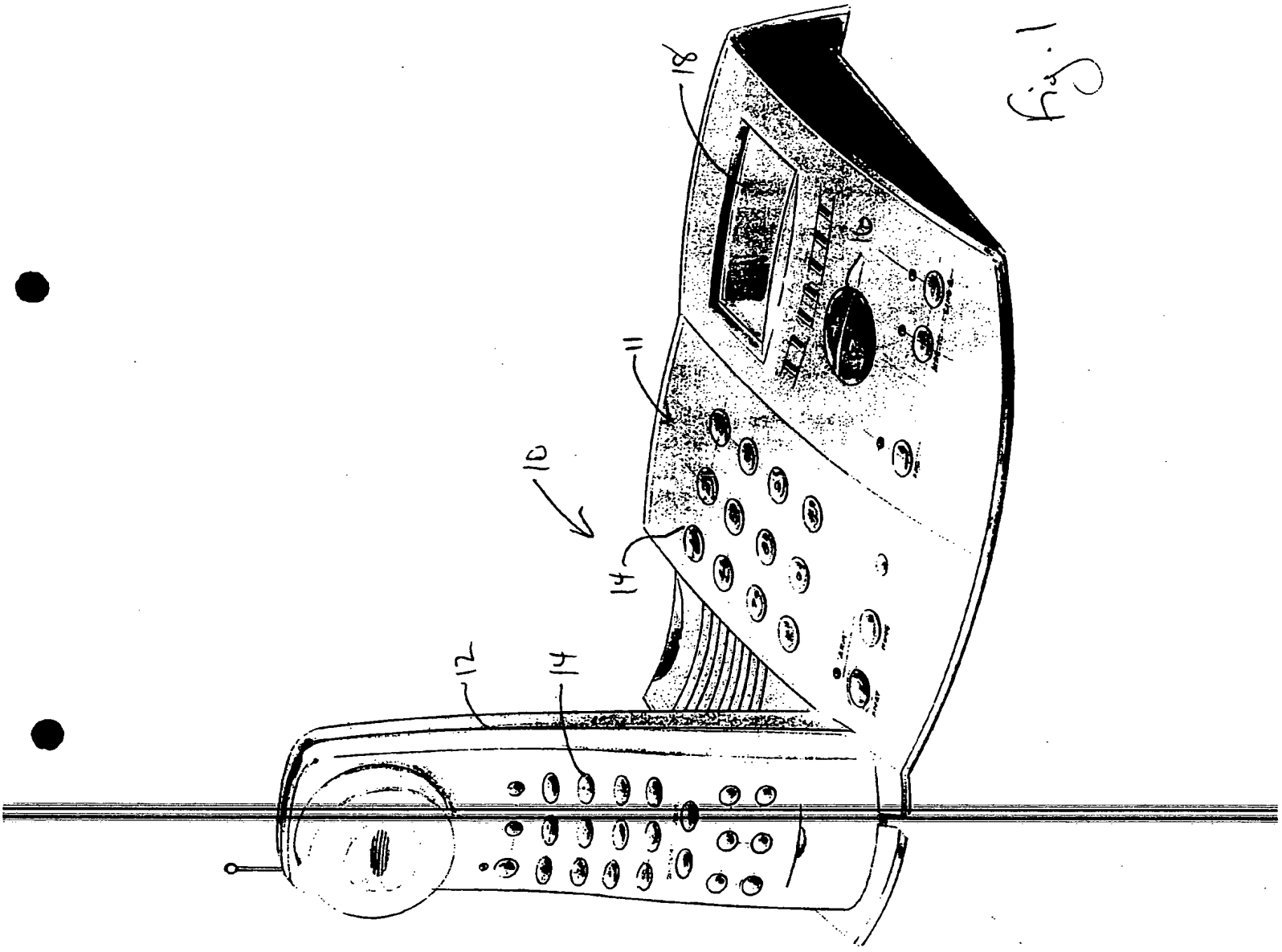

Fig. 1

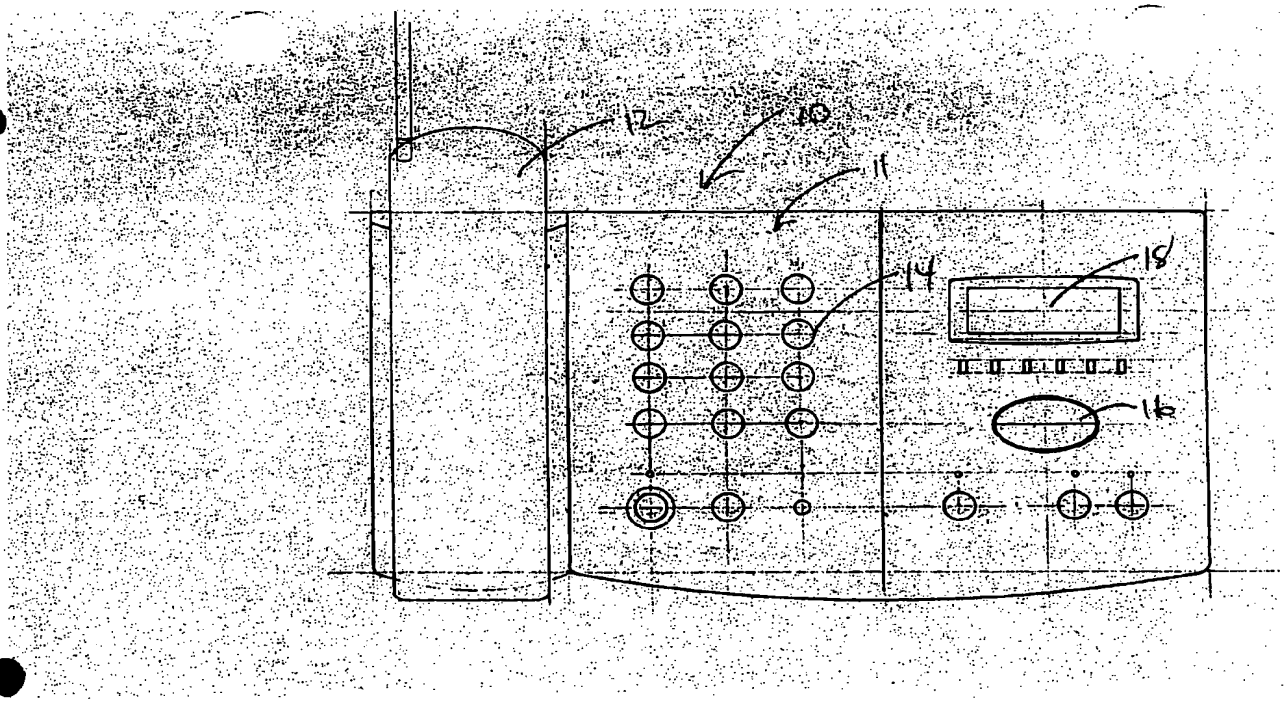

Fig 2

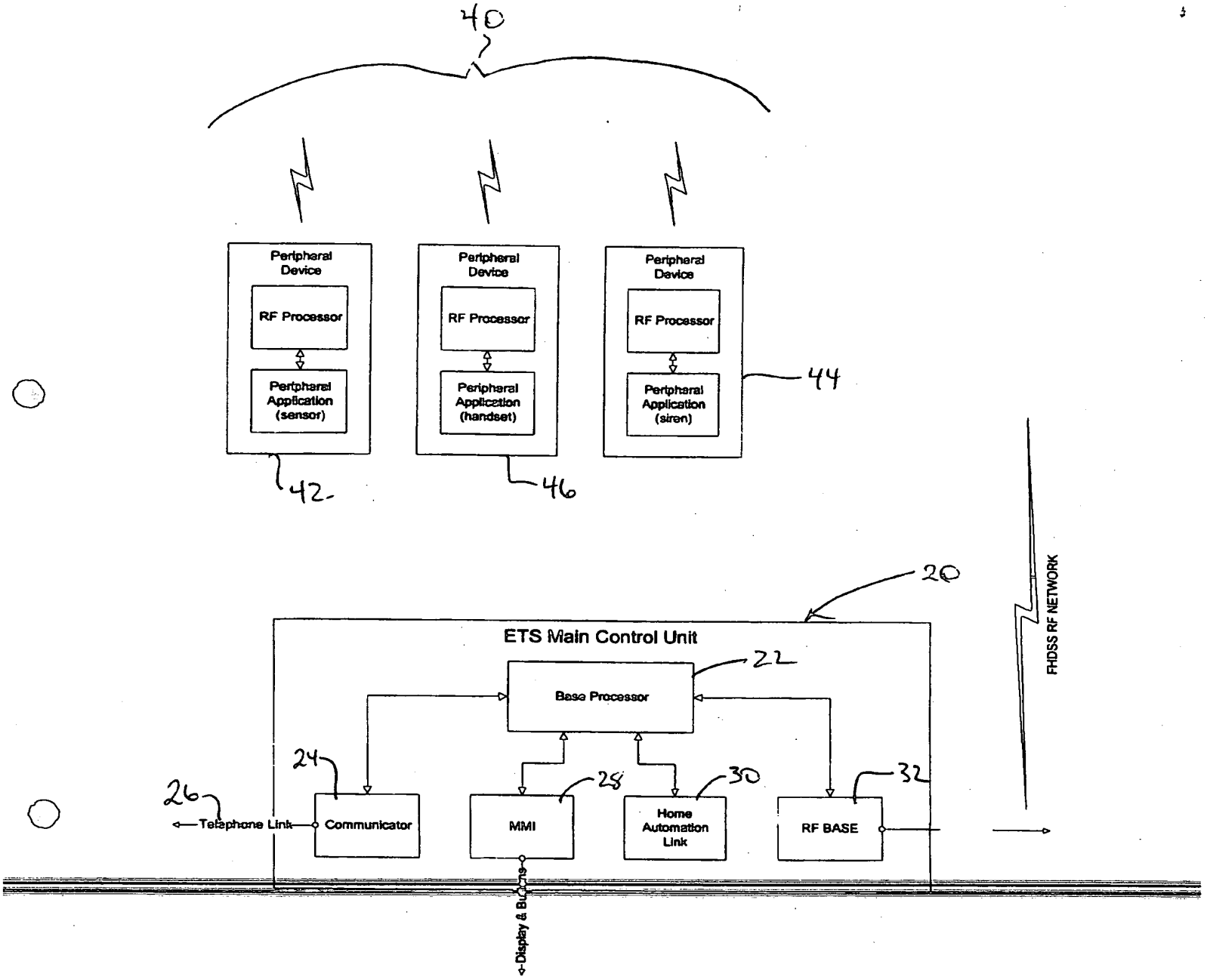
40
Peripheral Device
RF Processor
Peripheral Application (sensor)
42
Peripheral Device
RF Processor
Peripheral Application (handset)
46
Peripheral Device
RF Processor
Peripheral Application (siren)
44
20
ETS Main Control Unit
22
Base Processor
24
26
Telephone Link
Communicator
MMI
28
30
Home Automation Link
RF BASE
32
FHDSS RF NETWORK
Display & Buttons

Fig. 3